

## PATCH-SIZED FLUID DELIVERY SYSTEMS AND METHODS

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Divisional of U.S. patent application Ser. No. 12/395,000 filed Feb. 27, 2009 and entitled Patch-Sized Fluid Delivery Systems and Methods, now U.S. Pat. No. 10,293,117, issued May 21, 2019 (Attorney Docket No. H11), which is a Continuation of U.S. patent application Ser. No. 11/704,886 filed Feb. 9, 2007 and entitled Patch-Sized Fluid Delivery Systems and Methods, now U.S. Pat. No. 8,545,445, issued Oct. 1, 2013 (Attorney Docket No. E72), each of which is hereby incorporated herein by reference in its entirety, U.S. Pat. No. 8,545,445 claims priority from the following U.S. Provisional Patent Applications, all of which are hereby incorporated herein by reference in their entireties:

[0002] Ser. No. 60/772,313 for “Portable Injection System” filed Feb. 9, 2006 (Attorney Docket No. 1062/E42);

[0003] Ser. No. 60/789,243 for “Method of Volume Measurement for Flow Control” filed Apr. 5, 2006 (Attorney Docket No. 1062/E53); and

[0004] Ser. No. 60/793,188 for “Portable Injection and Adhesive System” filed Apr. 19, 2006 (Attorney Docket No. 1062/E46).

[0005] U.S. Pat. No. 8,545,445 is also a continuation of U.S. patent application Ser. No. 11/704,899, filed on Feb. 9, 2007, entitled Fluid Delivery Systems and Methods, now U.S. Pat. No. 8,414,522, issued on Apr. 9, 2013 (Attorney Docket Number 1062/E70), both of which are hereby incorporated herein by reference in their entireties. U.S. Pat. No. 8,414,522 claims priority to the following patent applications, each of which is herein incorporated by reference in its entirety:

[0006] Ser. No. 60/772,313, filed Feb. 9, 2006 and entitled Portable Injection System (Attorney Docket No. 1062/E42);

[0007] Ser. No. 60/789,243, filed Apr. 5, 2006 entitled Method of Volume Measurement for Flow Control (Attorney Docket No. 1062/E53); and

[0008] Ser. No. 60/793,188, filed Apr. 19, 2006 entitled Portable Injection and Adhesive System (Attorney Docket No. 1062/E46).

[0009] U.S. Pat. No. 8,545,445 is also a continuation of U.S. patent application Ser. No. 11/704,896, filed on Feb. 9, 2007, entitled Pumping Fluid Delivery Systems and Methods Using Force Application Assembly, now U.S. Pat. No. 8,585,377, issued on Nov. 19, 2013 (Attorney Docket Number 1062/E71), both of which are hereby incorporated herein by reference. U.S. Pat. No. 8,585,377 claims priority to the following patent applications, each of which is herein incorporated by reference in its entirety:

[0010] Ser. No. 60/772,313, filed Feb. 9, 2006 and entitled Portable Injection System (Attorney Docket No. 1062/E42);

[0011] Ser. No. 60/789,243, filed Apr. 5, 2006 entitled Method of Volume Measurement for Flow Control (Attorney Docket No. 1062/E53); and

[0012] Ser. No. 60/793,188, filed Apr. 19, 2006 entitled Portable Injection and Adhesive System (Attorney Docket No. 1062/E46).

[0013] U.S. Pat. No. 8,545,445 is a continuation of U.S. patent application Ser. No. 11/704,897, filed on Feb. 9, 2007, and entitled Adhesive and Peripheral Systems and Methods for Medical Devices, now U.S. Pat. No. 8,113,244, issued on

Feb. 14, 2012 (Attorney Docket Number 1062/E73), both of which are hereby incorporated herein by reference in their entireties. U.S. Pat. No. 8,113,244 claims priority to the following patent applications, each of which is herein incorporated by reference in its entirety:

[0014] Ser. No. 60/772,313, filed Feb. 9, 2006 and entitled Portable Injection System (Attorney Docket No. 1062/E42);

[0015] Ser. No. 60/789,243, filed Apr. 5, 2006 entitled Method of Volume Measurement for Flow Control (Attorney Docket No. 1062/E53); and

[0016] Ser. No. 60/793,188, filed Apr. 19, 2006 entitled Portable Injection and Adhesive System (Attorney Docket No. 1062/E46).

### FIELD OF THE INVENTION

[0017] This application relates generally to patch-sized fluid delivery systems and methods.

### BACKGROUND

[0018] Many potentially valuable medicines or compounds, including biologicals, are not orally active due to poor absorption, hepatic metabolism or other pharmacokinetic factors. Additionally, some therapeutic compounds, although they can be orally absorbed, are sometimes required to be administered so often it is difficult for a patient to maintain the desired schedule. In these cases, parenteral delivery is often employed or could be employed.

[0019] Effective parenteral routes of drug delivery, as well as other fluids and compounds, such as subcutaneous injection, intramuscular injection, and intravenous (IV) administration include puncture of the skin with a needle or stylet. Insulin is an example of a therapeutic fluid that is self-injected by millions of diabetic patients. Users of parenterally delivered drugs would benefit from a wearable device that would automatically deliver needed drugs/compounds over a period of time.

[0020] To this end, there have been efforts to design portable devices for the controlled release of therapeutics. Such devices are known to have a reservoir such as a cartridge, syringe, or bag, and to be electronically controlled. These devices suffer from a number of drawbacks including the malfunction rate. Reducing the size, weight and cost of these devices is also an ongoing challenge.

### SUMMARY OF THE INVENTION

[0021] In various embodiments of the present invention, a patch-sized housing for a fluid delivery system may include a reusable portion and a disposable portion that is removably engageable with the reusable portion. In terms of fluid delivery management, the disposable portion generally includes all of the fluid management components that come into contact with the fluid (e.g., a fluid path having various valve, pump, and/or dispensing regions bounded by flexible membrane material), while the reusable portion generally includes fluid management components that do not come into contact with the fluid (e.g., various valve actuators, pump actuators, and sensors that interface with the fluid path through the flexible membrane material). The reusable portion generally also includes most, if not all, of the components that would be considered reusable or non-disposable, such as, for example, a controller, an active mechanical assembly including a pump with valve and/or pump actuators and pump motor(s), one or more sensors (e.g., a fluid